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# Happiness of the oldest-old men is associated with fruit and vegetable intakes

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## Abstract

**Background** Positive emotions and happiness may improve health and prolong life. Diet quality, Mediterranean dietary pattern, fruit and vegetable, chocolate, and fish consumption have been linked to positive affect, improved mood, and reduced risk of depression. We examined the associations between diet, nutrition, and perceived happiness in the oldest-old men.

**Methods** The participants in this cross-sectional analysis were the oldest-old, home-dwelling men ( $n = 338$ , mean age 88 years, range 82–97 years) from the longitudinal Helsinki Businessmen Study cohort. In 2016, a postal health and nutrition survey was performed. Happiness was evaluated using the Visual Analog Scale of Happiness (0–100 mm). The nutrition survey included a 3-day food diary, Mediterranean Diet Adherence score, and Index of Diet Quality designed to measure adherence to Finnish dietary recommendations. The participants were divided into quartiles according to happiness scores, and diet quality scores, food intakes, and other indicators were compared between the happiness quartiles.

**Results** Happiness was linearly associated with total fruit and vegetable intakes ( $p = 0.002$ ) and inversely associated with age ( $p = 0.016$ ), blood glucose levels ( $p = 0.049$ ), skipping lunch ( $p = 0.023$ ), reduced food intake ( $p = 0.002$ ), and weight loss ( $p = 0.016$ ).

**Conclusions** Fruit and vegetable intakes indicated happiness in the oldest-old men while reduced food intakes and weight loss were inversely associated with happiness. Maintaining good nutrition and increasing fruit and vegetable consumption may be important for psychological health of older people.

**Keywords** Happiness · Fruits and vegetables intake · Oldest-old men · Nutrition

## Introduction

Happiness has been associated with various positive health outcomes [1]. Positive affect, optimism, and happiness can have beneficial effects on cardiovascular and immune systems, influence hormones, and inflammation [2–5]. Positive psychological characteristics have also been associated with longer telomere length [6]. Mediterranean diet, fruit and

vegetable intakes, and fish consumption have been linked to improved mood and reduced risk of depression [7–10]. In the present study, we examined associations between perceived happiness and nutrition in oldest-old men.

## Methods

The participants of this cross-sectional analysis were from the socioeconomically homogeneous cohort of the longitudinal Helsinki Businessmen Study (HBS, [11]). No systematic dietary surveys of this cohort have been performed earlier, but in 2016 a postal Health and Nutrition survey was sent to the surviving participants ( $n = 715$ ). Perceived happiness was evaluated with the Visual Analog Scale of Happiness, where the participant mark a point between 0 and 100 mm, 0 indicating the worst happiness score and 100 the best possible happiness score [12]. Weight loss and reduced food intake were measured using validated questions of the

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Mini Nutritional Assessment (MNA) questionnaire [13]. The questions were: weight loss during the last 3 months? (0 = over 3 kg; 1 = I don't know; 2 = weight loss 1–3 kg; 3 = no weight loss). Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties? (0 = severe decrease in food intake; 1 = moderate decrease in food intake; 2 = no decrease in food intake).

The nutrition survey included a 3-day food records and two validated diet quality indices including Mediterranean diet adherence score (MeDi) [14] and Index of Diet Quality (IDQ) designed to measure the adherence to the Finnish Nutrition Recommendations [15]. Food intakes were retrieved using the diet quality indices indicated as portions, glasses, or frequencies per week. Portion size was defined as follows: fruits and vegetables; 100 g or 1 average size fruit, 1.5–2 dL of cooked vegetables or salad; 1.5 dL of berries; 100–120 g of meats or fish; 1 slice or 30–35 g of bread; 2 dL of milk, sour milk, yogurt; 100 g of cooked beans, lentils or peas. The portion sizes were calculated to grams and validated with 3-day food diaries obtained from a subgroup of participants. Thus, we were able to compare the amounts of foods between different instruments (Table 1).

The survey also included other nutrition-related questions and self-reported blood glucose levels.

The participants were divided into quartiles of happiness scores, and age, diet quality scores, food intakes, blood glucose levels, and other nutrition-related indicators were compared between the happiness quartiles. The statistical significance of the hypotheses of linearity was evaluated for a trend using ANOVA for continuous variables, and Mantel–Haenszel test for categorical variables. Differences between food item quantities retrieved from diet quality indices and food records were tested with Kruskal–Wallis test. Statistical analyses were performed using the SPSS statistical program, version 24 (SPSS IBM, Armonk, NY, USA).

## Results

The survey was returned by 476 participants (response rate 67%), and 338 filled both the survey and the diet quality indices. A subgroup of the participants ( $n = 142$ ) returned 3-day food records. Mean age of the respondents was 88 years (range 82–97). The mean happiness score was 73.9. There were no statistical differences between amounts of food items retrieved from diet quality indices or 3-day food records (Table 1).

Perceived happiness was linearly associated with total fruit and vegetable intake ( $p = 0.002$ ) and with both fruit ( $p = 0.014$ ) and vegetable intakes ( $p = 0.016$ ) (Table 2). On the contrary, happiness scores were inversely associated with age ( $p = 0.016$ ), self-reported blood glucose levels ( $p = 0.049$ ), skipping lunch ( $p = 0.023$ ), reduced food intake ( $p = 0.002$ ), and weight loss ( $p = 0.016$ ). Other food intakes or diet quality index scores (MeDi, IDQ) were not associated with happiness.

## Discussion

In our study, fruit and vegetable intakes were positively associated with perceived happiness in the oldest-old men, whereas age, self-reported blood glucose levels, decreased food intake, skipping lunch, and weight loss were inversely associated with perceived happiness. Other food intakes or diet quality index scores (MeDi, IDQ) were not associated with happiness.

Cross-sectional study cannot prove cause and effect, but there are several reasons why fruit and vegetable intakes could be associated with happiness. Fruits and vegetables are rich sources of various micronutrients such as vitamins A, C, folates, and other B-vitamins along with soluble fiber that are essential for the normal brain function and gut

**Table 1** Comparison of amounts of foods retrieved from 3-day food records and diet quality indices approach on the estimated amounts of food items consumed

Food items g/day	Amounts retrieved from diet quality indices (MeDi, DQI) $n = 338$	3-day food records $n = 142$	$p$ value <sup>a</sup>
Total fruits and vegetables	278	253	NS
100% juice	111	46	NS
Fish	42	45	NS
Meat	19	55	NS
Poultry	20	19	NS
Peas and beans	8	8	NS
Liquid milk products including milk, sour milk, drinkable yogurt	374	259	NS
Cereals, bread, pasta	n.a	n.a	n.a.

MeDi Mediterranean diet adherence score, DQI Diet Quality Index, n. a not applicable

<sup>a</sup>Statistical significance for the happiness quartiles was tested with Kruskal–Wallis test

**Table 2** Food and diet-related issues according to happiness quartiles in Helsinki Businessmen cohort

Happiness quartiles ( <i>Q</i> )	<i>Q</i> <sub>1</sub> Happiness <i>n</i> =79	<i>Q</i> <sub>2</sub> Happiness <i>n</i> =82	<i>Q</i> <sub>3</sub> Happiness <i>n</i> =82	<i>Q</i> <sub>4</sub> Happiness <i>n</i> =68	<i>p</i> value <sup>a,b</sup>
<b>Characteristics</b>					
Happiness, mm (SD)	52.6 (13.1)	72.7 (3.3)	81.5 (2.2)	91.8 (4.0)	< <b>0.001</b>
Age, mean years (SD)	88.1 (4.1)	87.9 (3.8)	86.9 (3.2)	86.9 (3.2)	0.016
<b>Food intakes</b>					
Total fruit and vegetable, g/day (SD)	220 (131)	260 (232)	296 (230)	337 (332)	0.002
Vegetables, g/day (SD)	119 (81)	109 (82)	146 (150)	158 (151)	0.014
Fruits, g/day (SD)	107 (86)	150 (199)	152 (134)	177 (228)	0.016
100% fruit juice, g/day (SD)	99 (133)	105 (127)	117 (218)	121 (177)	0.370
Peas and beans, g/day (SD)	9 (16)	6 (10)	12 (21)	9 (7)	0.474
Fish, g per week (SD)	265 (169)	312 (218)	280 (148)	286 (176)	0.676
Milk, sour milk, drinkable yogurt g/day (SD)	356 (296)	360 (325)	415 (589)	396 (385)	0.398
Red meat, g per week (SD)	133 (133)	161 (280)	133 (168)	112 (112)	0.470
Poultry, g per week (SD)	175 (63)	161 (63)	168 (63)	168 (63)	0.799
Bread, g per day (SD)	128 (64)	110 (62)	112 (59)	123 (80)	0.640
Chocolate, g per week (SD)	20 (57)	26 (88)	15 (34)	23 (75)	0.938
<b>Diet quality</b>					
MeDi (SD)	4.2 (1.5)	4.2 (1.2)	4.4 (1.6)	4.7 (1.9)	0.069
IDQ (SD)	9.6 (1.9)	9.6 (1.9)	10.3 (1.6)	9.8 (1.8)	0.101
<b>Other nutrition-related issues</b>					
Blood glucose, mmol/l	6.2 (1.4)	6.2 (1.2)	5.9 (0.9)	5.8 (0.7)	0.049
Skip lunch days per week	0.9 (2.2)	0.5 (1.4)	0.4 (1.2)	0.4 (1.4)	0.023
<b>Reduced food intake, %</b>					
Yes, considerably	3	0	0	0	0.002
Yes, moderately	11	10	4	4	
No	86	90	96	96	
<b>Weight loss, %</b>					
> 3 kg or don't know	16	10	8	8	0.016
1–3 kg	20	19	12	13	
No weight loss	64	71	80	78	

*Q* quartile, *SD* standard deviation, *IDQ* Index of Diet Quality, *MeDi* Mediterranean diet adherence score

<sup>a</sup>Statistical significance of linearity was tested by ANOVA

<sup>b</sup>Statistical significance linearity was tested by Mantel–Haenszel test

microbiota [5]. Fruits and vegetables also contain abundant amounts of phytochemicals such as carotenoids and flavonoids which are important for health [5, 16], and abundant fruit and vegetable intake has been associated with better mood and reduced risk of depression [4]. Although fish intake has been associated with reduced risk of depression and positive psychological well-being in some studies, it was not associated with happiness in our participants [3]. However, in all happiness quartiles fish intake was quite high which may explain why no differences between the groups were detected. Chocolate intake was associated with a higher feeling of happiness in a longitudinal analysis conducted in the same cohort at a younger age [17]. However, in the present analysis where participants were older, chocolate intake was not associated with happiness.

In the National Findiet 2012-survey, older men (65–74 years) reported eating 245 g of fruits and vegetables per day, which is similar to the lowest quartile (*Q*<sub>1</sub>) in our participants [18]. Thus, intake of fruits and vegetables was relatively high in our cohort compared to that in the general population.

Skipping lunch, reduced food intake, and weight loss as well as blood glucose levels were inversely associated with happiness. All these factors are indicators of deteriorating health and advancing frailty in older people and may thus be the reason for reduced happiness scores.

The strength of this study is a relatively high participation of the oldest-old men. Food records are considered one of the best ways to measure dietary intakes of older people, because they do not rely on short-term memory.

Moreover, 3-day food records are generally thought to be of sufficient duration to get an accurate picture of person's dietary intakes [19]. However, food records may be biased through considerable under- or over-reporting of consumed foods. Since we were only able to get the food diaries from a subgroup of participants, the nutrition data were gathered using various instruments which allowed us to compare them with one another and validate the reported consumption. Furthermore, the nutrition questionnaires were checked and verified by a nutritionist, who also made follow-up calls to check food quantities and types of food items to ensure the correctness of the data. The participants of this cohort differed in many ways from the general population by being the oldest-old remaining men from the upper socioeconomic class, thus are a selected group even in this cohort, as it is likely that the physically or mentally frailest men in this cohort were unable to return the survey.

The cross-sectional design of the study is a major limitation and it prevents drawing conclusions about causal relationships. Happiness is a subjective measure and several social and physical conditions may interfere with reported happiness. Healthier dietary pattern and good health status alone may not be responsible for the association, although good health and nutrition certainly may contribute to higher subjective happiness. Therefore, it is not possible to conclude on basis of this study whether a healthier dietary pattern or other factors are responsible for the association.

In conclusion, fruit and vegetable intakes indicated happiness while variables of ill health were inversely associated with happiness. Thus, maintaining good nutrition in old age may be important not only for the general health, but also for the psychological health of older people. It would be interesting to have studies on happiness and diet in other countries and with more varying intakes.

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## Compliance with ethical standards

**Conflict of interest** SKJ: reports no conflict of interest. AU: reports no conflict of interest. KHP: reports no conflict of interest. TES: reports having various educational and consultative cooperation with several companies, including Nutricia, Abbott, Amgen, Merck, Pfizer, Novartis, and Novo-Nordisk; a minor amount of stock in Orion Pharma; and is a board member and former president of executive board of European Union Geriatric Medicine Society which has cooperation also with the nutrition industry.

**Ethical approval** The study protocol was approved by the Ethics Committee of the Helsinki University Hospital, Department of Medicine.

**Informed consent** Informed consent was obtained from all individual participants included in the study.

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